US 20140305545A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2014/0305545 A1**

(43) **Pub. Date: Oct. 16, 2014**

Butler, JR.

(54) **AUTOMATED SYSTEM FOR FUELING VEHICLES**

(71) Applicant: **Charles Roland Butler, JR.**, High Point, NC (US)

(72) Inventor: **Charles Roland Butler, JR.**, High Point, NC (US)

(21) Appl. No.: **13/863,093**

(22) Filed: **Apr. 15, 2013**

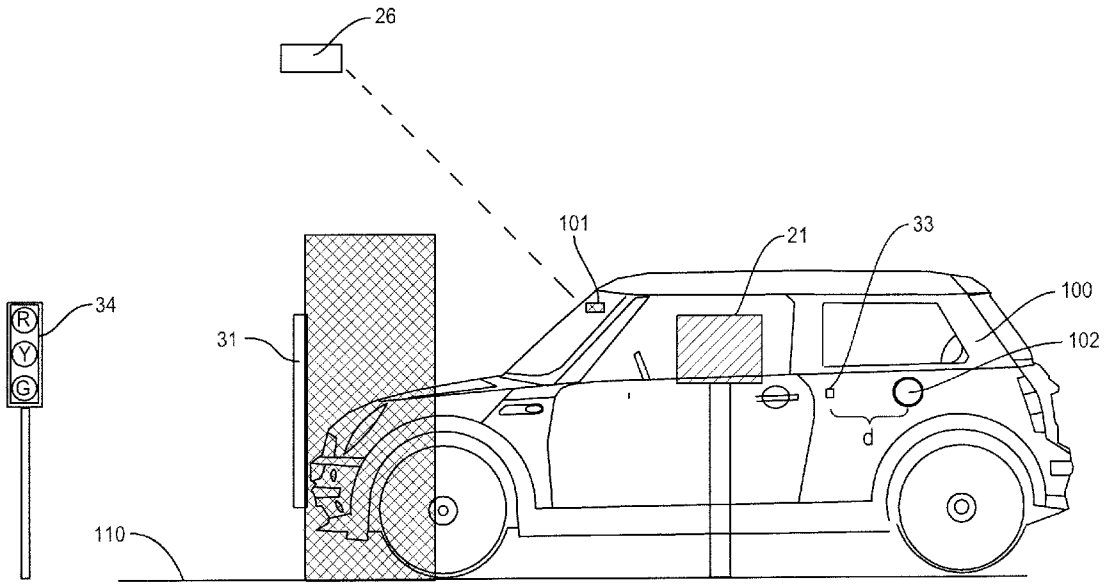
Publication Classification

(51) **Int. Cl.**
B67D 7/04 (2006.01)

(52) **U.S. Cl.**
CPC ***B67D 7/0401*** (2013.01); *B67D 2007/0461* (2013.01)
USPC **141/94**

(57) **ABSTRACT**

An automated fueling system in which an operator remains in their vehicle. The fueling system is configured to obtain transaction information from the operator, align the vehicle relative to a fuel pump, and to deliver the fuel to the vehicle. Once the process is complete, the operator can drive their vehicle away from the station.



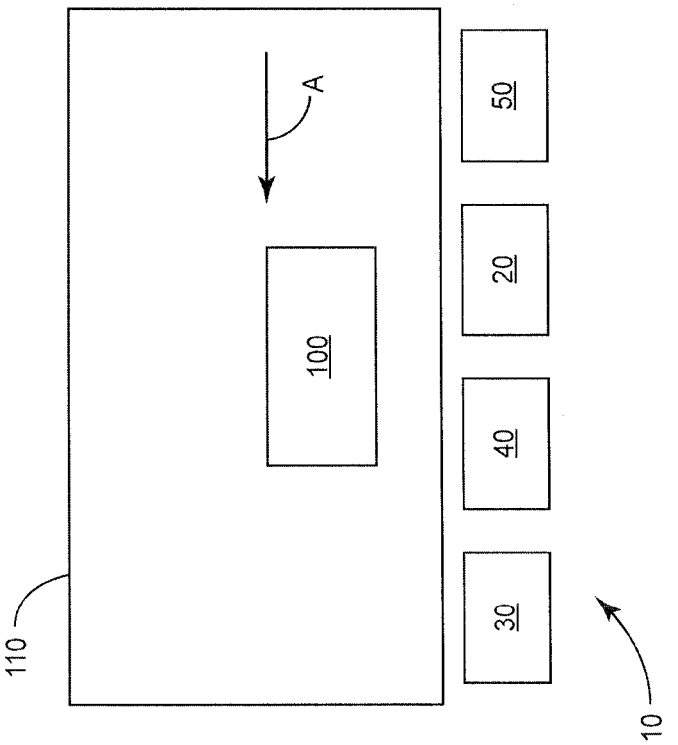


FIG. 1

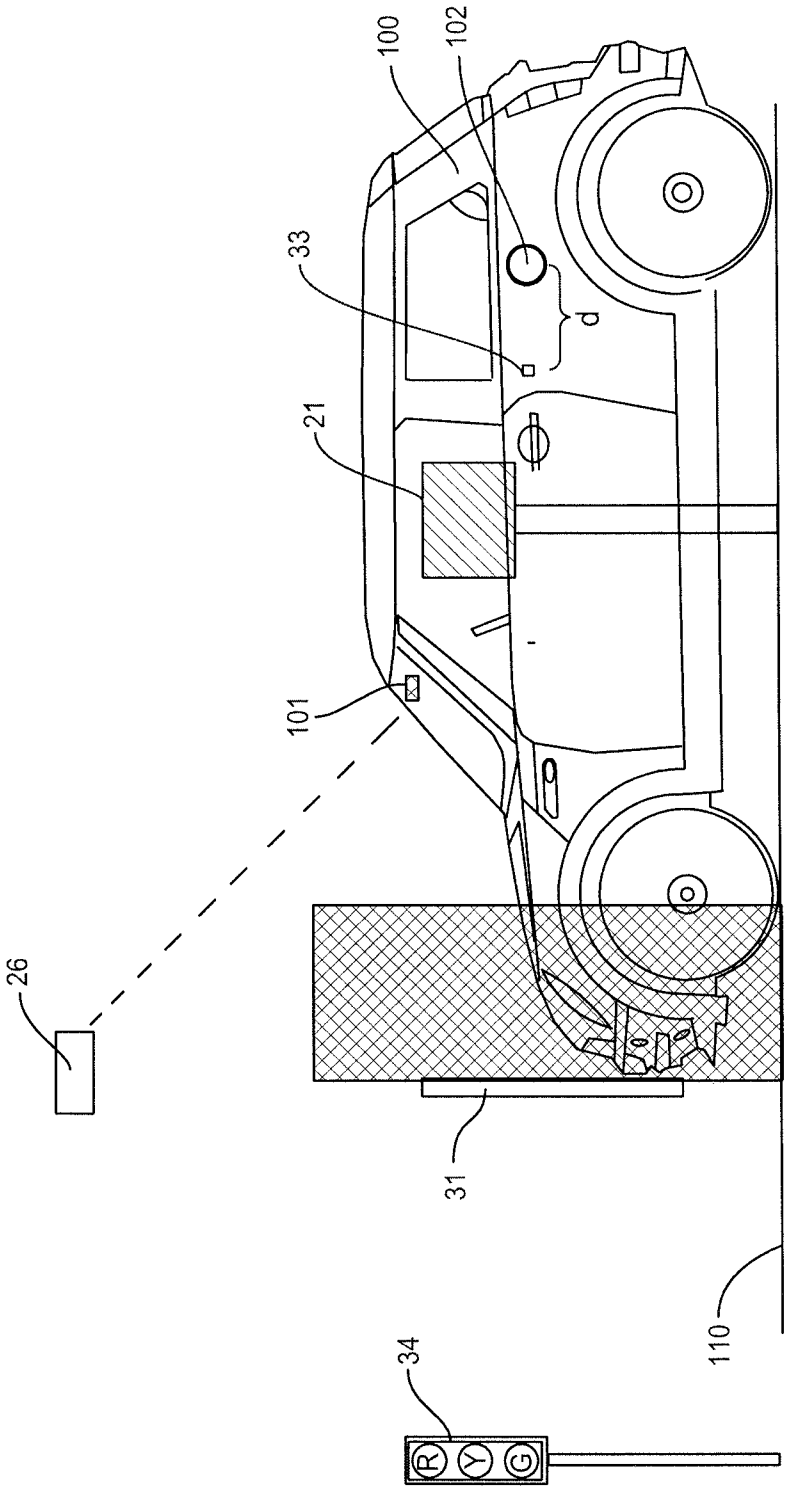


FIG. 2

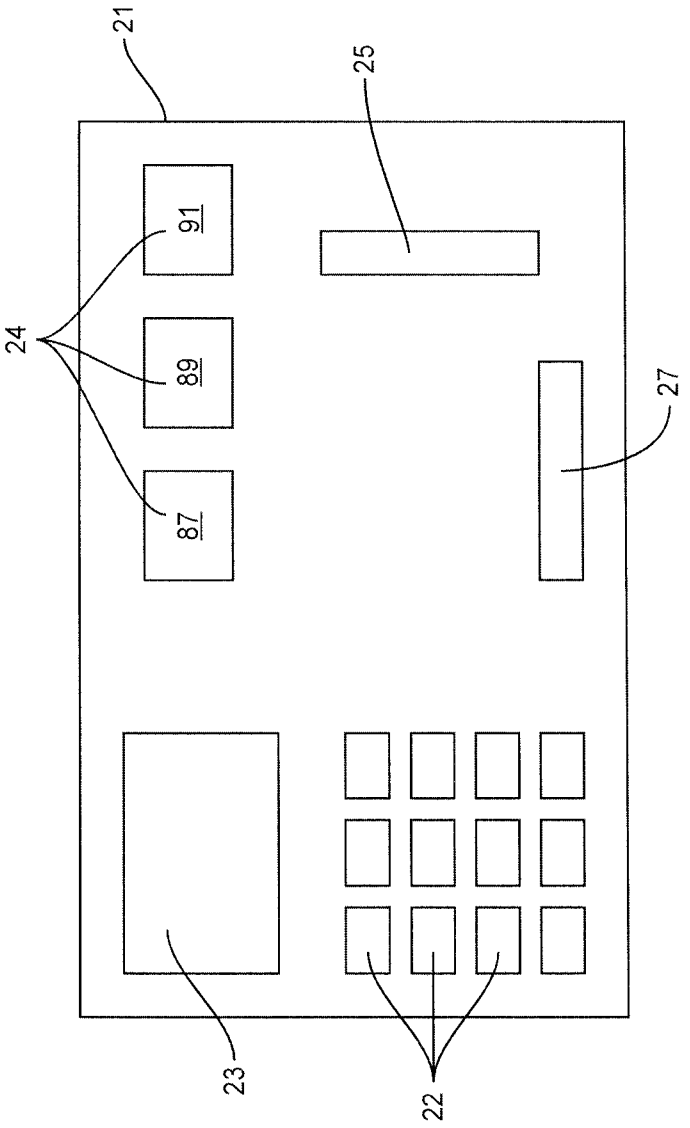


FIG. 3

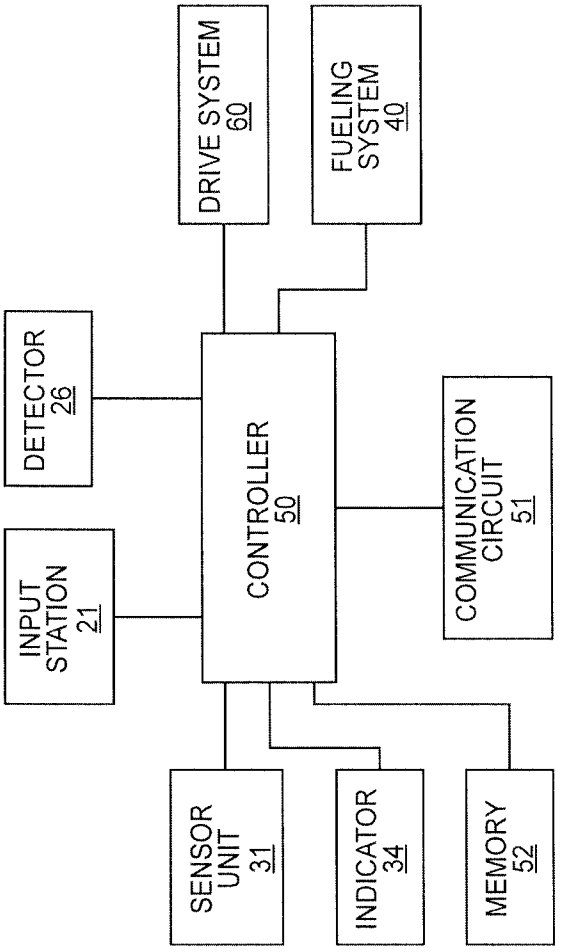

DRIVE SYSTEM 60
FUELING SYSTEM 40
DETECTOR 26
CONTROLLER 50
COMMUNICATION CIRCUIT 51
INPUT STATION 21
SENSOR UNIT 31
INDICATOR 34
MEMORY 52

FIG. 4

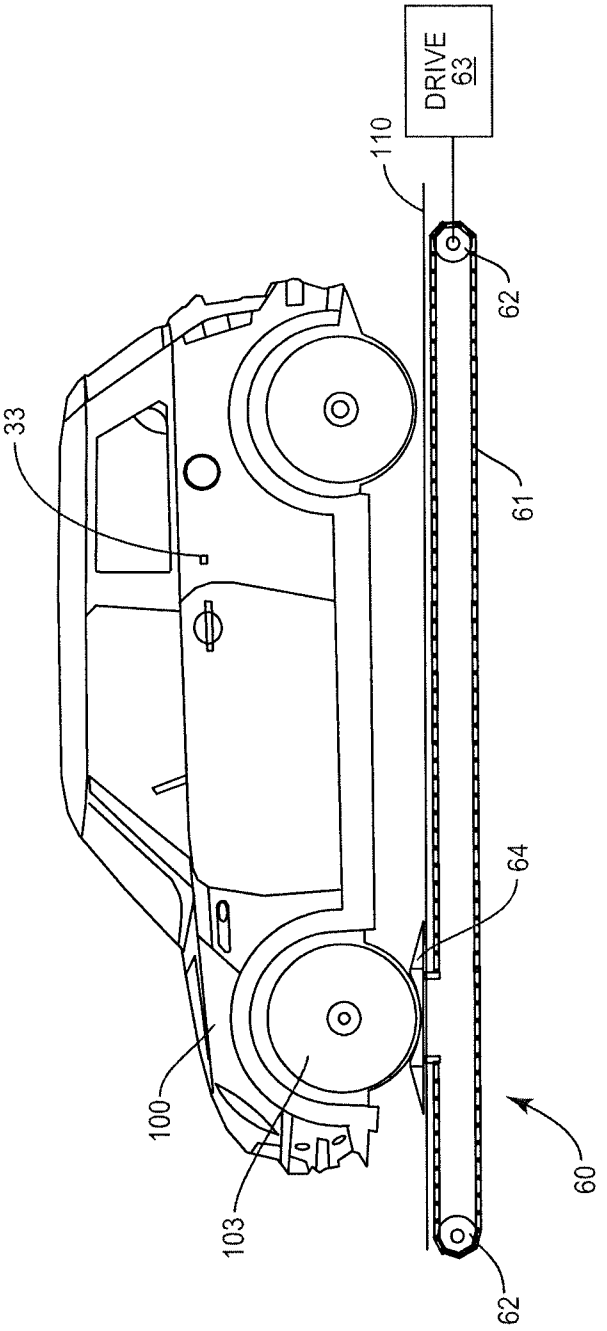


FIG. 5

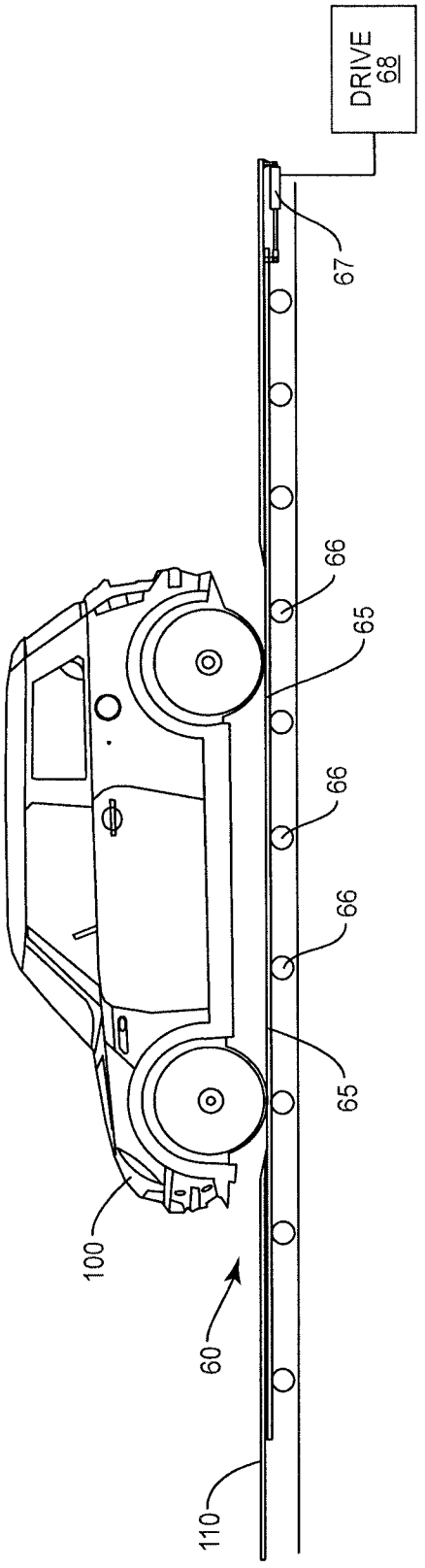


FIG. 6

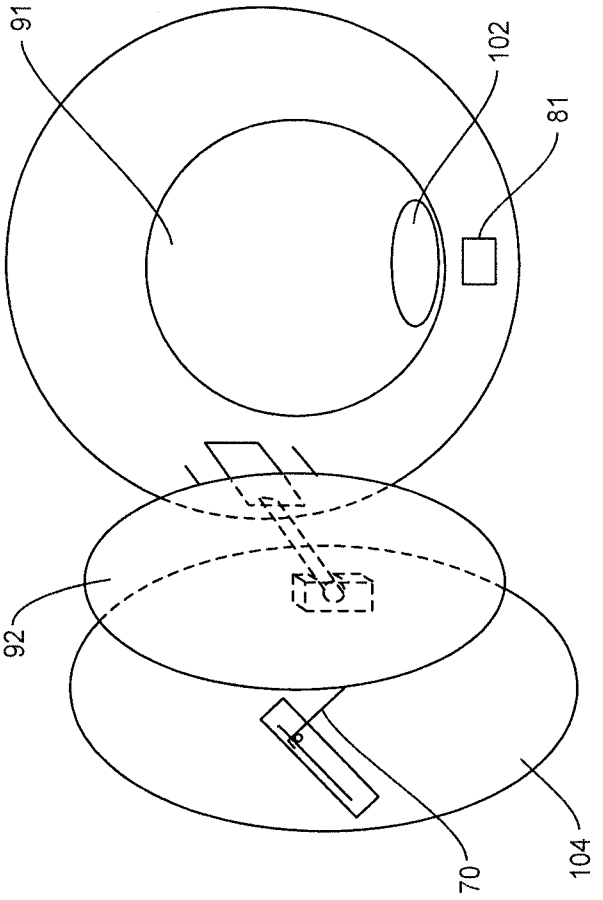


FIG. 7

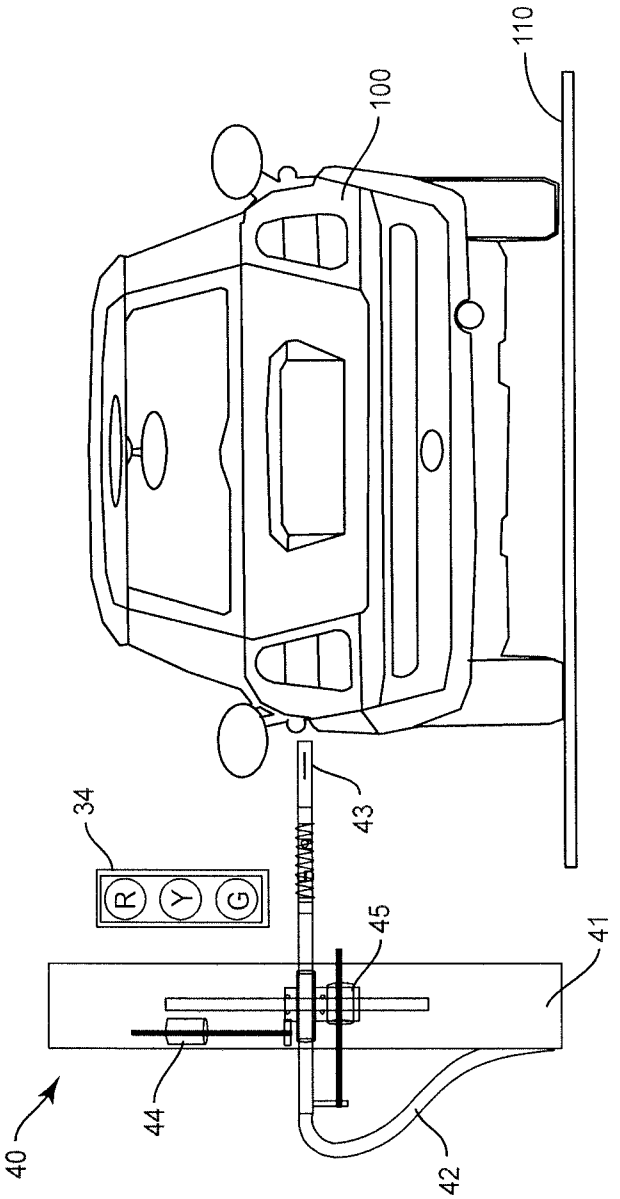


FIG. 8

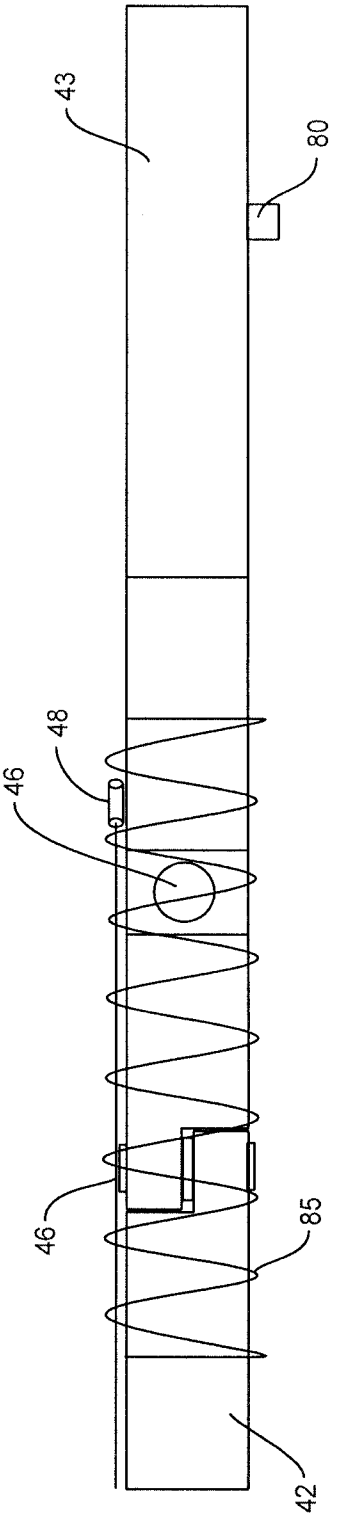


FIG. 9

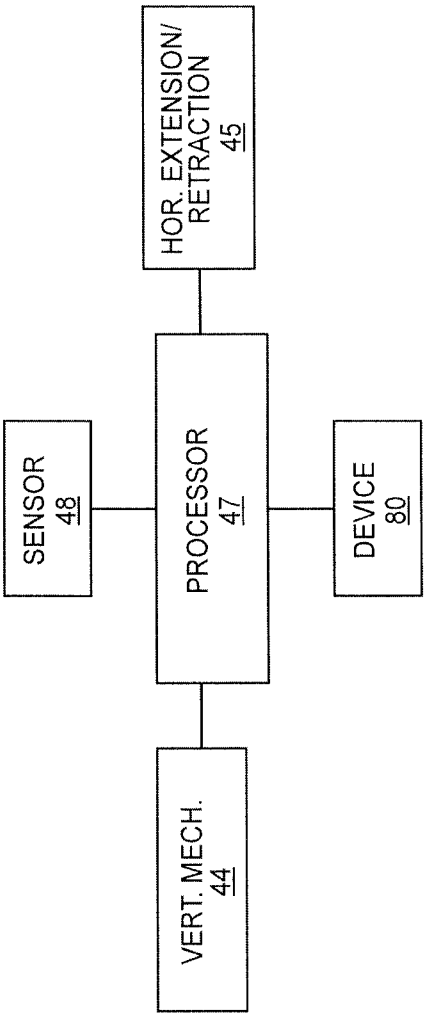

HOR. EXTENSION/
RETRACTION
45
SENSOR
48
PROCESSOR
47
DEVICE
80
VERT. MECH.
44

FIG. 10

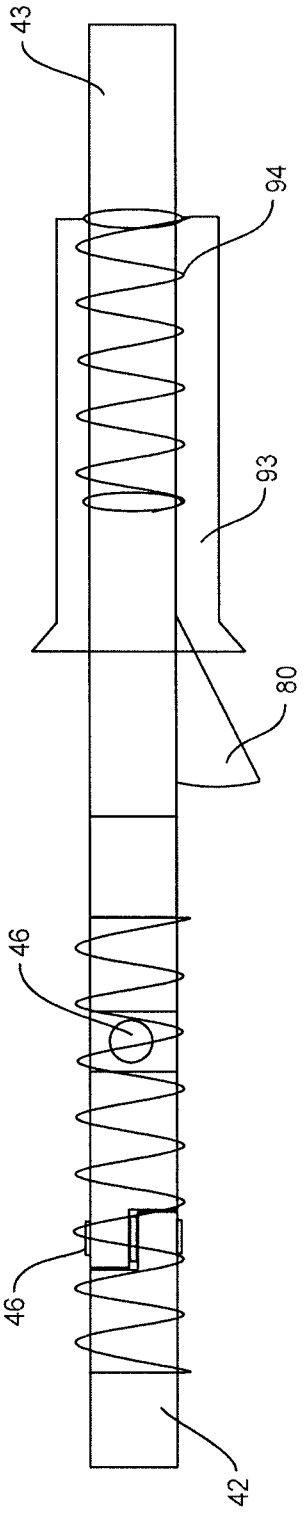


FIG. 11

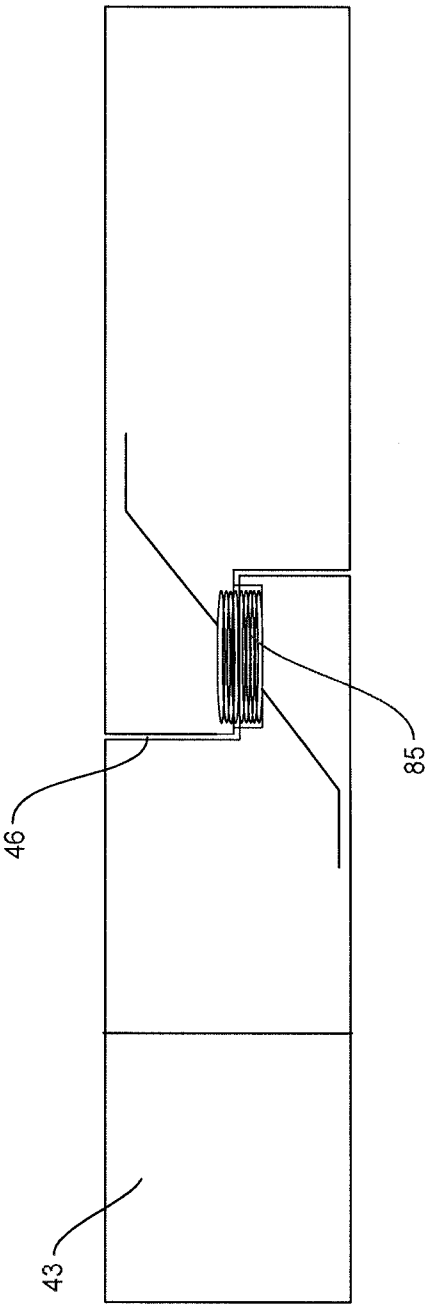


FIG. 12

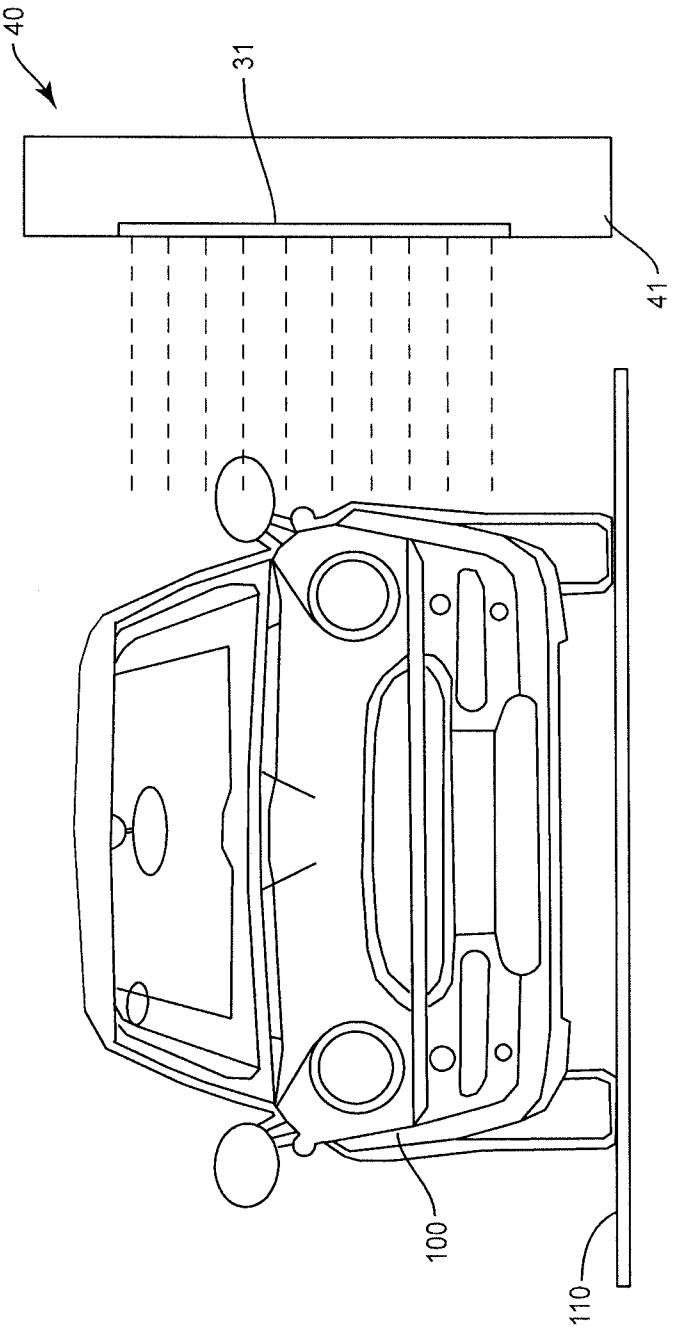


FIG. 13

AUTOMATED SYSTEM FOR FUELING VEHICLES

BACKGROUND

[0001] The present application is directed to a system for fueling vehicles and, more particularly, an automated fueling system in which the vehicle operator remains in the vehicle during the fueling process.

[0002] Fueling stations are commonplace in today's society. The most readily seen station is a gas station that includes one or more fuel pumps that are able to dispense one or more different types of fuel. A vehicle operator drives their vehicle to one of the pumps and stops their vehicle. The operator then exits the vehicle to pay for the fuel and then dispense the fuel. At some stations, the operator may be required to walk to a nearby kiosk or store to pay for the fuel. Alternatively, the pump may be equipped with an interface to receive credit card payment. The user may also remove a fuel nozzle and corresponding hose from the pump and place the nozzle into the gas tank in their vehicle to dispense the fuel. Once complete, the nozzle and hose are returned to the pump, the user closes their fuel tank, and is then able to drive away in their vehicle. This type of fueling system includes a variety of disadvantages.

[0003] One disadvantage is the vehicle operator is required to exit the vehicle. Exiting the vehicle may expose the operator to unsafe conditions in which they may be robbed or worse. This is more likely in certain circumstances, such as when the operator is alone, the fueling occurs at night, or the station is in an area with a history of crime.

[0004] Exiting the vehicle also exposes the operator to adverse weather conditions. It may be raining at the time of fueling thus causing the operator to get wet while they perform the refueling. Likewise, the weather may be frigidly cold or excessively hot, either of which exposes the operator to be placed in physically uncomfortable situations.

[0005] From a business efficiency perspective, requiring the operator to exit the vehicle to fuel their vehicle is a relatively slow process that limits the throughput of the number of fuelings that can occur within a given time period. Operators may spend an excessive amount of time to complete the fueling due to a variety of different factors, such as being unfamiliar with how to pump the fuel, and being unfamiliar with the payment interface. This reduces the number of operators that can be serviced and thus may reduce the profitability of the station.

SUMMARY

[0006] The present application is directed to an automatic fueling system for delivering fuel to a vehicle. In general, the system includes a payment system, an alignment system, and a fueling system. The driver may remain in their vehicle during the fueling process.

[0007] One embodiment of using the system includes that the driver pulls up to a payment system that may include a credit card machine or a cash receiving machine. The driver enters desired amount of fuel and makes the payment. The driver then pulls forward until an indicator illuminates indicating that a nozzle of the fueling system is aligned with the vehicle fuel inlet relative to the horizontal position of the car. The alignment position of the vehicle may be the same for the various vehicles that are serviced by the system. This may include various positions relative to the fueling system. Once aligned, the fuel door is opened and the vehicle ignition is disabled. In one specific embodiment, the vehicle includes an automatic fuel button that disables the car ignition circuit and at the same time opens the gas lid door. The fuel nozzle is then moved vertically to align with the fuel inlet. When aligned, the nozzle extends into the funnel and into the neck of the fuel inlet. There is a sensor that stops the fuel nozzle at a fixed distance into the tank. When sensors are aligned, this stops the nozzle and makes the pump start pumping the desired amount of fuel. When the desired amount of fuel is pumped, the pump will turn off and the nozzle automatically starts retracting. When the nozzle starts retracting, the sensor will signal that the nozzle is no longer in the fueling position. Once complete, the driver will push the automatic fuel button on the dash again, which will close the fuel door and enable the ignition of the car so the car can be started and driven away.

[0008] Another embodiment is directed to an automated system to fuel a vehicle such that a user remains within the vehicle during fueling. The system includes a drive system with a support member configured to be positioned under the vehicle and sized to receive at least one tire of the vehicle with the drive system configured to move the support member and the vehicle along a lane. An alignment system is configured to be positioned at a stationary point along the lane and configured to horizontally align the vehicle at a predetermined position along the lane as the vehicle is being moved by the drive system. The alignment system includes a first target mounted to the vehicle at a first distance from a fuel inlet of the vehicle and a first sensor to detect the first target when the vehicle is at the predetermined position. The system also includes a fueling system configured to be positioned along the lane and including a hose, a second sensor mounted to the hose, and a second target mounted to the vehicle at a second predetermined distance from the fuel inlet. The second target is spaced apart from the first target, and the sensor is configured to detect the second target to vertically align the hose with the fuel inlet. The fueling system is further configured to extend the hose outward towards the vehicle to insert the hose into the fuel inlet when the second target is detected and the hose is aligned with the fuel inlet.

[0009] The system may include that the fueling system has a pump housing that is stationary relative to the drive system with the hose being movable relative to the pump housing.

[0010] The system may include that the first and second targets are different.

[0011] The system may include that the drive system has an elongated chain that is powered by a motor with the support member being connected to the chain.

[0012] The system may include that the support member is a flat plate and the drive system further includes an actuator operatively connected to the plate to move the plate along the lane.

[0013] The system may include that the fueling system is configured to detect the second target after the vehicle has been horizontally aligned along the lane by the alignment system.

[0014] The system may include an actuator system to open a fuel door that extends across the fuel inlet.

[0015] Another embodiment is directed to an automated system to fuel a vehicle such that a user remains within the vehicle during fueling. The system includes a first target configured to be positioned on the vehicle at a first location; a second target configured to be positioned on the vehicle at a second location that is separate from the first target; a fueling

system configured to deliver the fuel to the vehicle and including a body and a hose with the hose configured to move relative to the body between extended and retracted positions; a first sensor configured to horizontally align the vehicle with the fueling system as the vehicle moves through the system with the first sensor configured to detect the first target when a fuel inlet of the vehicle is horizontally aligned with the fueling system; and a second sensor configured to vertically align the hose with the fuel inlet of the vehicle with the second sensor configured to detect the second target when the hose is vertically aligned with the fuel inlet. The fueling system is configured to move the hose from the retracted position to the extended position when the first and second targets are detected by the first and second alignment systems.

[0016] The system may include that the second sensor is positioned on the hose of the fueling system.

[0017] The system may include a payment system that includes a module configured to be positioned on the vehicle and a sensor to detect the module.

[0018] The system may include that the first and second targets include different sizes.

[0019] The system may include a drive system configured to move the vehicle from a first point to the fueling system while the vehicle is off.

[0020] The drive system may include a chain drive with a dolly configured to receive a tire of the vehicle.

[0021] The drive system may include a plate sized to receive at least a portion of the vehicle and an actuator configured to move the plate from the first point to the fueling system.

[0022] The system may include an actuator system to open a fuel door that extends across the fuel inlet with the actuator system configured to open the fuel door after the first sensor detects the first target.

[0023] Another embodiment is directed to an automated system to fuel a vehicle such that a user remains within the vehicle during fueling. The system includes a controller configured to: determine that the vehicle is moving along a lane; receive a first signal from a first sensor that detects a first target on the vehicle indicating that a fuel inlet of the vehicle is horizontally aligned with a fuel hose; stop the vehicle when the fuel inlet is horizontally aligned with the fuel hose; vertically move the fuel hose relative to the fuel inlet; receive a second signal from a second sensor when the second sensor detects a second target indicating that the fuel hose is vertically aligned with the fuel inlet of the vehicle; extend the fuel hose outward towards the vehicle; receive a third signal from a third sensor when the fuel hose is inserted into the fuel inlet of the vehicle; and deliver fuel through the fuel hose to the vehicle after receiving the third signal.

[0024] The system may include that the controller is further configured to start vertically moving the fuel hose after receiving the first signal from the first sensor.

[0025] The system may include that the second sensor is connected to the fuel hose.

[0026] The system may include that the first sensor is configured to detect the first target that is positioned on a leading side of the fuel inlet and the second sensor is configured to detect the second target that is positioned on an opposing trailing side of the fuel inlet.

[0027] The system may include that the controller is further configured to receive payment prior to delivering the fuel to the vehicle.

[0028] The various aspects of the various embodiments may be used alone or in any combination, as is desired.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] FIG. **1** is a schematic view of an automated fueling system.

[0030] FIG. **2** is a schematic side view of a vehicle positioned in a lane of an automated fueling system.

[0031] FIG. **3** is a front view of an interface station of a payment system.

[0032] FIG. **4** is a schematic view of elements of an automated fueling system.

[0033] FIG. **5** is a schematic side view of a vehicle on a drive system that moves the vehicle along a lane.

[0034] FIG. **6** is a side view of a vehicle on a drive system that moves the vehicle along a lane.

[0035] FIG. **7** is a schematic view of fuel door, a funnel cover, an opening of a funnel, a target, and a fuel inlet.

[0036] FIG. **8** is a rear schematic view of a vehicle positioned at a fueling system with a fuel hose partially extended from a fuel body.

[0037] FIG. **9** is a schematic side view of a fuel hose including a pair of joints and a sensor to detect a target.

[0038] FIG. **10** is a schematic view of elements of a fueling system.

[0039] FIG. **11** is a side schematic view of a nozzle of a fuel hose inserted partially within a tube at a fuel inlet.

[0040] FIG. **12** is a side schematic view of a hose with a joint having a biasing member to maintain a straight orientation.

[0041] FIG. **13** is a front schematic view of a vehicle positioned relative to an alignment system that includes at least one sensor unit.

DETAILED DESCRIPTION

[0042] The present application is directed to an automated fueling system in which an operator remains in their vehicle. The fueling system is configured to obtain transaction information from the operator, align the vehicle relative to a fuel pump, and to deliver the fuel to the vehicle. Once the process is complete, the operator can drive their vehicle away from the station.

[0043] FIG. **1** is a schematic view of an automated fueling system **10**. The system **10** is incorporated into a fueling station with a lane **110** configured to service the vehicle **100** that moves in the direction of arrow A. The system **10** includes a payment system **20** for paying for the fuel that is to be delivered to the vehicle **100**. The system **10** also includes an alignment system **30** for aligning the vehicle **100** in the proper position to receive the fuel. The system **10** also includes a fueling system **40** for delivering the fuel to the vehicle **100**. The system **10** may also include a controller **50** that oversees and controls the fueling system **10**.

[0044] The payment system **20** is configured for the user to pay for the fuel that is delivered to their vehicle **100**. The payment system **20** may also be configured for the user to select the type of fuel (e.g., 87 octane, 89 octane, 91 octane, diesel). Further, the payment system **20** may be configured for the user to select the amount of fuel. In some embodiments, the user is required to pay for their fuel prior to proceeding through the system **10**. Other embodiments provide for the user to pay after the fuel is delivered to their vehicle.

[0045] As illustrated in FIG. **2**, the payment system **20** may include an interface station **21** positioned in proximity to the lane **110**. The interface station **21** is positioned to be accessed by a user who is sitting in their vehicle. FIG. **3** illustrates an embodiment of the interface station **21** for the user to make their applicable selections regarding the fueling transaction. The interface station **21** may include a card reader **25** for a user to slide their credit card to enter credit information. Further, input keys **22** and a screen **23** may provide for the user to enter additional information that may be necessary for the transaction, such as credit card information and an amount of fuel. Separate input keys **24** may be designated for the user to select the desired fuel type. The interface station **21** may further include an insertion slot **27** configured to receive paper currency that is input by the user. Associated with the insertion slot is a change dispenser for dispensing coins to the user.

[0046] The payment system **20** may also include electronic collection. As illustrated in FIG. **2**, electronic collection includes a sensor **26** configured to detect an on-board module **101** positioned on the vehicle **101**. The sensor **26** is positioned in proximity to the lane **100** to read the module **101** and obtain the relevant information. The module **101** is positioned on the vehicle **100** at a point that is able to be read by the sensor **26**. Examples of positioning may include on the dashboard, back window, or side window. The sensor **26** and module **101** may include a variety of different technologies, including but not limited to RFID and bar-code technology.

[0047] The user sets up an account with the system that allows them to use the fueling process. The account includes information for billing purposes, such as the user's name, address, and payment information. The account may also include fueling preferences, such as type of fuel, amount of fuel to be delivered during a stop, and vehicle information. The module **101** includes identification information that is detected by the sensor **26** and used for accessing the user's account. The account information is then used for completing the fueling process and relevant charges are billed to the account.

[0048] In some embodiments, the payment process includes usage of just one of the interface station **21** or the sensor **26**/module **101**. In other embodiments, the two aspects are used in combination. For example, the user may initially select the amount and type of fuel through the interface station **21**. The user may then input an option such that the fuel is charged to the account that is detected by the sensor **26** through the module **101**.

[0049] A controller **50** may oversee the fueling process of the system **10**, including the payment system **20**. As illustrated in FIG. **4**, the controller **50** may include one or more processors, controllers, hardware circuits, and/or a combination thereof to control the various systems **20**, **30**, **40**, and the various components associated with the system **10**. Controller **50** may include memory **52** that stores needed data and programs needed to execute program code to control the various systems **20**, **30**, **40** and their functions. Controller **50** may include one or several types of memory, including read-only memory, random-access memory, flash memory, magnetic or optical storage devices, or the like. In some embodiments, one or more physical memory units may be shared by the various systems **20**, **30**, **40**. Other embodiments may have physically separate memories for one or more of the different systems **20**, **30**, **40**.

[0050] The controller **50** may also include a communications circuit **51** for communications with one or more of the other systems and components. The circuit **51** may include an antenna to facilitate the communications. The circuit **51** may include a radio frequency transmitter and receiver for transmitting and receiving signals through the antenna. Controller **50** may also be wired to one or more of the components of the systems **20**, **30**, **40**.

[0051] The communications circuit **51** may also provide for communicating with a controller in the vehicle. Communications circuit **51** may be configured to exchange data with the vehicle over short distances, such as through Bluetooth technology and the like.

[0052] The alignment system **30** provides for aligning the vehicle **100** relative to the fueling system **40**. This alignment may provide for horizontally positioning a fuel inlet **102** of the vehicle with the fueling system **40**. As illustrated in FIGS. **2** and **13**, the alignment system **30** includes a sensor **31** positioned in proximity to the lane **110**.

[0053] The alignment system **30** also includes a target **33** that is detected by the sensor **31**. The target **33** may include a variety of different aspects. Examples of the target **33** include a reflector, laser, photoelectric transmitter or receiver, proximity switch, bar code, laser detector, and edge alignment device. In one embodiment, the target **33** emits a signal that is detected by the sensor **31**. In another embodiment, the target **33** is passive and does not emit a signal. In one embodiment as illustrated in FIG. **13**, the sensor **31** includes one or more transceivers that emit a signal and receive a returned signal that indicates the position of the target on the vehicle **100**.

[0054] The target **33** is connected to the vehicle **100** in an orientation to be detected by the sensor **31**. In one embodiment as illustrated in FIG. **2**, the target **33** is positioned on the vehicle **100** at a predetermined location. In one embodiment, the target **33** is positioned a predetermined distance d from the fuel tank inlet **102**. The distance d may be based on the distance that the sensor unit **31** is positioned from the fueling system **40** as will be explained in more detail below. Depending upon one or more of the sensor **31**, the target **33**, and the fueling system **40**, target **33** may be positioned at a variety of locations on the vehicle **100**.

[0055] In use, the sensor unit **31** is directed towards the lane **110** and scans the vehicle **100** as it passes. The sensor unit **31** detects the target **33** at a point where the vehicle **100** is positioned along the lane **110** with the fuel inlet **102** aligned with the fueling system **40**. The detection of the target **33** by the sensor unit **31** causes the system **10** to stop the vehicle **100** from moving farther along the lane **110**.

[0056] The system **10** may be configured for the user to drive their vehicle **100** along the lane **110** until the alignment system **30** detects the target **33**. To facilitate the positioning of the vehicle **100**, the alignment system **30** may further include an indicator **34** positioned in the dash of the vehicle **100** or along the lane **110** to indicate to the user the position of the vehicle **100**. Indicator **34** may include one or more lights that are illuminated depending upon the position of the vehicle. In one embodiment, the indicator **34** includes a green light, yellow light, and a red light. Initially, the green light is illuminated as the vehicle **100** is moving along the lane **110**. As the vehicle **100** approaches the fueling system **40**, the yellow light is illuminated to indicate to the user that the vehicle **100** is approaching the predetermined position. The red light is illuminated when the vehicle **100** reaches the predetermined position and the sensor **31** detects the target **33**.

[0057] In one embodiment, the sensor **31** is able to determine when the target **33** is approaching the predetermined alignment position. The sensor **31** may receive a first signal having a first characteristic when the target **33** is approaching. This may result in the yellow light being displayed on the indicator **34**. The sensor **31** may also be configured to receive a second signal with a different second characteristic when the target **33** is aligned with the alignment position. This results in the red light being displayed on the indicator **34**. In one embodiment, the characteristic is a signal strength of a signal that is emitted by the sensor **31**, reflected from the target **33**, and detected by the sensor **31**. As the target approaches the alignment position the signal strength is a first amount. When the target reaches the alignment position, the signal strength is a second amount.

[0058] The vehicle **100** may move along the lane **110** in different manners. In one embodiment, the vehicle **100** is driven by the user from the payment system **20** to the fueling system **40**. In another embodiment, the system **10** includes a drive system **60** to move the vehicle **100** along the lane **110**. FIG. **5** includes a drive system **60** that includes a chain **61** that extends around gears **62** and is driven by a motor **63**. The system further includes a dolly **64** configured to receive one or both front tires **103** of the vehicle **100**. In use, the user drives the vehicle **100** and positions the front tires **103** on the dolly **64**. The drive system **60** is then powered thereby moving the vehicle **100** along the lane **110**. The drive system **60** is powered until the vehicle **100** is aligned with the fueling system **40**.

[0059] FIG. **6** illustrates another drive system **60** that includes an actuator drive. The system **60** includes a member **65** positioned at the lane **110** on a set of rollers **66**. An actuator **67** and associated drive motor **68** is operatively connected to the member **65**. The vehicle **100** is driven onto the member **65** and moved along the lane **110** to the alignment position at the fueling system **40**.

[0060] In the various embodiments, the vehicle **100** is moved to the fueling system **40**. If the user is driving the vehicle **100**, the user is instructed to turn off the ignition switch. The user may receive this instruction through various techniques, such as a sign that is flashed on a nearby screen and an audio message played for the user. In embodiments with a drive system **60**, the vehicle **100** may be shut off at the time the vehicle **100** is placed on the drive system **60**,

[0061] The system **10** may be further configured to determine that the vehicle **100** is off during the fueling process. System **10** may include one or more sensors, such as noise sensors or vibration sensors that detect if the vehicle is on. The system **10** may further be configured to communicate with the vehicle **100** through the communications circuit **51** to ensure that the vehicle **100** is off. In the event the vehicle **100** is turned on during the fueling process, the controller **50** may be configured to shut down the fueling and terminate the transaction.

[0062] The fuel inlet **102** of the vehicle **100** is protected by a fuel door **104**. To facilitate the fueling process and prevent the user from exiting the vehicle **100**, the system **10** may be configured to open the fuel door **104**. In one embodiment, the driver presses an automatic fuel button that disables the vehicle ignition system and opens the fuel door **104**. The fuel door **104** includes an actuator **70** as illustrated in FIG. **7**. The actuator **70** opens the fuel door **104** when the vehicle **100** is at the fueling system **40**. The actuator **70** may be operated in various ways, including electric, hydraulic, pneumatic, and vacuum devices. In one embodiment, actuator **70** includes a receiver that receives a signal from the controller **50** when the fuel door **104** is to be opened. Actuator **70** is further configured to close the fuel door **104** once the fuel has been delivered to the vehicle **100**. In one embodiment, the driver presses the automatic fuel button on the dash which closes the fuel door and enables the vehicle ignition system.

[0063] The fuel inlet **102** may also include a funnel **91** to facilitate insertion of a hose of the fueling system **40**. The funnel **91** is positioned behind the fuel door **104** and includes an enlarged opening that aligns with the fuel door and a smaller opening that extends into the fuel inlet **102**. A cover **92** may extend across the funnel opening. The cover **92** may be connected to the fuel door **104** and be opened and closed with the fuel door **104**. In another embodiment, a separate actuator may be connected to the cover **92** and controlled via a signal received from the controller **50** or the automatic fuel button.

[0064] A second target **81** is attached to the vehicle **100** in proximity to the fuel inlet. The second target **81** is detected by a sensor **48** on the fueling system **40** when a hose **42** of the fueling system **40** is aligned with the fuel inlet **102**. Examples of the target **81** include a reflector, laser, photoelectric transmitter or receiver, proximity switch, bar code, laser detector, and edge alignment device. In one embodiment, the target **81** emits a signal that is detected by the sensor **48**. In another embodiment, the target **81** is passive and does not emit a signal. In one embodiment, the sensor **48** includes one or more transceivers that emit a signal and receive a returned signal that indicates the position of the target **81**.

[0065] The second target **81** may be spaced away from the first target **33**. This spacing prevents the first sensor **31** from detecting the second target **81**, or the second sensor **48** from detecting the first target **33**. The targets **33**, **81** may have the same or different configurations.

[0066] In one embodiment, the first target **33** is positioned in front of the fuel inlet **102** (i.e., between the fuel inlet **102** and the front of the vehicle **100**), and the second target **81** is positioned at a point between the fuel inlet **102** and a back of the vehicle **100**. In one embodiment as illustrated in FIG. **7**, the target **81** is covered by the fuel door **104**. The target **81** is not detectable by the sensor **48** until the fuel door **104** is opened.

[0067] The fueling system **40** provides for delivering fuel to the vehicle **100**. FIG. **8** illustrates the fueling system **40** with an aligned vehicle **100**. The fueling system **40** includes a fuel pump housing **41** and a fuel hose **42**. A nozzle **43** is positioned at the distal end of the fuel hose **42**. The system **40** also includes a vertical movement mechanism **44** for vertically positioning the nozzle **43** relative to the fuel inlet **102** of the vehicle **100**, and an extension/retraction mechanism **45** for inserting and removing the nozzle **43** relative to the fuel inlet **102**. The mechanisms **44**, **45** may include various aspects, such as servo motors and linear actuators, and may include the same or different configurations.

[0068] As illustrated in FIG. **9**, the hose **42** may include one or more joints **46** to provide further adjustability for inserting the nozzle **43** into the fuel inlet **102**. The joints **46** may be positioned at or spaced away from the nozzle **43**. In one embodiment, two or more joints **46** are positioned at different angular orientations to provide for adjustability in two different directions. In the embodiment of FIG. **9**, a first joint **46** provides for adjustment in the horizontal plane, and a second joint **46** provides for adjustment in the vertical plane. One or

more of the joints **46** may be spring tensioned to remain straight until contact with the opening in the fuel inlet **102**. FIG. **12** includes an embodiment with the hose **42** including separate sections that are connected together to form the joint **46**. A biasing member, such as a torsion spring, may be positioned into an internal cavity at the joint **46**. In another embodiment as illustrated in FIG. **9**, a coil spring **85** is placed over the outside of the joint **46**. The various configurations of the biasing members are configured to maintain the hose **42** straight until contact with the fuel inlet **102**.

[0069] The hose **42** may further include a sensor **48** configured to detect the position of the target **81**. In one embodiment, the sensor **48** includes one or more transceivers that emit a signal and receive a returned signal that indicates the position of the target **81**. In one embodiment, the element **39** is a reflective member that is detected by the sensor **48**.

[0070] The sensor **48** may be configured to send signals to a processor **47** of the fueling system **40** as illustrated in FIG. **10**. The processor **47** receives the signals from the sensor **48** and controls the vertical movement mechanism **44** accordingly. In another embodiment, the fueling system **40** does not include a separate processor **47**. Rather, controller **50** receives the signals from the sensor **48** and controls the movement mechanism **44** to vertically position the nozzle **43**.

[0071] In use, the vehicle is horizontally aligned with the fueling system through the alignment system **30**. After horizontal alignment, the fuel door **104** is opened. This is initiated by the driver pressing an automatic fuel button, which also disables the ignition. In another embodiment, the controller **50** may send a signal to the vehicle **100** to initiate opening of the fuel door **104**. The fueling system **40** is configured to vertically align the hose **42** with the fuel inlet **102**. This occurs by the vertical movement mechanism **44** being activated to vertically move the hose **42** relative to the vehicle **100**. The sensor **48** detects the target **81** when the hose **42** is aligned and the vertical movement mechanism **44** is stopped. In one embodiment, the hose **42** may initially be a first vertical position either above or below the fuel inlet **102**. The vertical movement mechanism **48** is then operated in a first direction until the sensor **48** detects the target **81**.

[0072] Once the hose **42** is horizontally and vertically aligned with the fuel inlet **102**, the extension mechanism **45** is activated to move the hose **42** outward away from the body **41** and towards the vehicle **100** and into the fuel inlet **102**. The position of the nozzle **43** within the inlet **102** may be verified by a device **80** on the nozzle **43**. Device **80** may include a sensor or switch that detects the position of the nozzle **43**. Embodiments may include a magnetic reed switch, photocell, laser sensor, photocell reflector, or other device designed to provide feedback to the fueling system **40**.

[0073] In one embodiment as illustrated in FIG. **11**, the device includes a mechanical pump valve **80** that is biased to a first position. The nozzle **43** includes a tube **93** with a captured spring **94**. During extension, the nozzle **43** is inserted into the fuel inlet **102**. This causes the valve **80** to be depressed to start fuel flow. At this position, the fueling system **40** delivers fuel through the hose **42** and into the vehicle **100**.

[0074] After the fuel is delivered, the mechanism **45** retracts the hose **42** away from the vehicle **100**. When the nozzle **43** is removed from the tube **93**, the outward movement releases the pump valve **80**. The hose **42** may be moved to a fully retracted position where it is ready for the next fueling process in a subsequent vehicle. The fuel door **104** is further closed over the fuel inlet **102**.

[0075] Once the vehicle **100** is fueled, the user may drive the vehicle **100** away from the system **10**. In one embodiment, the indicator **34** may illuminate the first light indicating that it is safe for the vehicle **100** to pull away from the system **10**.

[0076] The processor **47** may oversee the operation of the fueling system **40**. The processor may include one or more processors, controllers, hardware circuits, and/or a combination thereof to control the system **40**. Processor **47** may also include memory that stores needed data and programs needed to execute program code to control the system **40**.

[0077] In another embodiment, the fueling system **40** does not include a separate processor **47**. Rather, the system controller **50** controls the operation of the fueling system **40**.

[0078] In one embodiment, a user with an existing vehicle **100** may desire to use the system **10**. This requires the user to establish an account for purposes of payment, and also establish preferences that are used during the fueling process. The vehicle **100** is further equipped to use the system **10**. This work may be performed by the user, may require the use of a skilled technician, or both. The work includes placing the first and second targets **33**, **81** on the vehicle **100**. The first target **33** is placed on the vehicle **100** for detection by the alignment system **30**. In one embodiment as illustrated in FIG. **2**, the first target **33** is placed a predetermined distance d away from the fuel inlet **102**. In a specific embodiment, the first target **33** is placed in front of the fuel inlet **102** a distance that corresponds to the distance between the alignment system **30** and the hose **42** of the fueling system **40**. The second target **81** is also placed on the vehicle **100** at a second distance from the fuel inlet **102**. In one specific embodiment, the second distance is the length between the sensor **48** and a center of the nozzle **43**. The targets **33**, **81** may be mounted to the vehicle **100** in a variety of different manners, such as with adhesives and mechanical fasteners.

[0079] Additional retrofitting of the vehicle **100** may include mounting the module **101** at a position to be read by the sensor **26**. This may include placement within the vehicle such as on the dashboard when the module **101** includes electrical components. This may also include placement on a window (exterior or interior side) when the module **101** comprises a bar code or other identification indicia that is read by the sensor **26**.

[0080] Retrofitting may also include mounting a funnel **91** within the opening for the fuel inlet **102**. Likewise, an actuator **70** may be mounted on the vehicle **100** to remotely open the fuel door **104**.

[0081] For a new vehicle **100**, these components may be factory installed during the vehicle manufacturing process.

[0082] In use, the user drives their vehicle **100** to a gas station that includes the automated fueling system **10**. The user initially positions their vehicle at the payment system **20** to begin the process. The system **10** may determine the payment through the sensor **26** that reads the module **101**, through inputs entered by the user through the interface station **21**, or both. The system **10** also determines the amount of fuel to deliver to the vehicle **100**. This may be a specific fuel amount or dollar amount that is input by the user, or an indication by the user to deliver enough fuel to fill the vehicle fuel tank.

[0083] In one embodiment, the payment system **20** is located at a starting point of a lane **110**. In the embodiment of FIG. **2**, the payment system **20** is spaced away from the

alignment system **30** and the fueling system **40**. Other embodiments may include the various components positioned at various locations relative to the lane **110**.

[0084] Once the payment information and fuel information is received by the system, the vehicle **100** is moved along the lane **101** and aligned along the lane by the alignment system **30**. In one embodiment, the user drives the vehicle **100** along the lane to the proper position. In this embodiment, the indicator **34** may signal to the user their relative position and the additional amount of movement required to obtain the horizontal alignment. The indicator **34** may initially display a first signal (e.g., a green light) when the vehicle **100** is relatively far from the alignment position, a second signal (e.g., yellow light) when the vehicle is approaching the alignment position, and a third signal (e.g., red light) when the vehicle is at the alignment position.

[0085] During movement of the vehicle horizontally along the lane **100**, the sensor **31** is active to detect the first target **33**. In one embodiment, the sensor **31** is stationary and senses a particular horizontal position along the lane **110**. In another embodiment, the sensor **31** may be movable to detect a range of horizontal positions. As the vehicle **100** moves along the lane **110**, the sensor **31** scans the vehicle **100** for the target **33**. When the vehicle **100** moves a distance to position the target at the detected position, the system **100** stops the forward movement of the vehicle **100**. This positioning includes the fuel inlet **102** being horizontally aligned with the hose **42**.

[0086] In another embodiment, the system **10** includes a drive system **60** to move the vehicle **100** along the lane **110** to the alignment system **30**. The user may drive the vehicle **100** along the lane **110** to position at least a portion of the vehicle **100** on a conveyance mechanism. This may include placing the front tires on a dolly **64** or placing the entire vehicle on a movable platform **65**. Once positioned, the system **10** activates the drive system **60** and moves the vehicle **100** along the lane **110**. The vehicle **100** is moved a distance until the sensor **31** detects the first target **33** at the detected position.

[0087] In some embodiments, the sensor **31** is able to detect the approach of the vehicle **100** to the detected position. This may occur by the sensor **31** detecting a particular signal when the target **33** is in the vicinity of the detected position. This may also include the sensor **31** being movable and detecting the target **33** at a point close to but away from the detected position. Readings from the sensor **31** may be used by the controller **50** to illuminate the relevant aspects of the indicator **34**.

[0088] Once the vehicle **100** is horizontally aligned, the system **10** may ensure that the vehicle is off (i.e., the ignition switch is turned off). The system **10** may include one or more sensors that detect the condition of the vehicle **100** and ensure it remains in this setting. In the event the vehicle **100** is turned on, the system **10** is configured to stop the fueling process.

[0089] At some point in the process, the system **10** opens the fuel door **104** that extends over the fuel inlet **102**. This may occur by the controller **50** sending a signal to an actuator **70** to open the door **104**.

[0090] Once horizontally aligned, the fueling system **40** vertically aligns the hose **42** with the fuel inlet **102**. Initially, the hose **42** may be at a retracted position away from the lane **110** and in a minimum or maximum vertical position. The system **10** activates a vertical movement mechanism **44** and moves the hose **42** vertically. A sensor **48** on the hose **42** detects the alignment with a second target **81**. When the hose **42** moves to a vertical position with the sensor **48** aligned with the target **81**, the vertical movement mechanism **44** is stopped to maintain the vertical position of the hose **42**.

[0091] At this point, the hose **42** is horizontally and vertically aligned with the fuel inlet **102**. The fueling system **40** then activates an extension mechanism **45** to move the hose **42** to extend outward to insert the nozzle **43** into the fuel inlet **102**. The fuel inlet **102** may be equipped with a funnel **91** and tube **93** to facilitate the insertion of the nozzle **43**. Due to the various angles the fuel inlet **102** may be oriented to, the nozzle **43** may need to have one or more horizontal and vertical swivel joints **46** to facilitate the insertion of the nozzle **43**. These joints **46** may be spring tensioned to remain straight until contact with the fuel inlet **102**. In one embodiment, the joints **46** are configured to bend upon contact with a funnel **91** at the fuel inlet **102**. The spring tensioning to maintain the nozzle **43** in a straight orientation may be accomplished by a torsion spring positioned in an internal cavity of the joint **46**, or a coil spring placed over the outside of the joint **46** to hold the nozzle **43** in the straight orientation until contact with the fuel inlet **102**. The hose **42** may be equipped with a device **80** to detect when the nozzle **43** is inserted in to the fuel inlet **104**. The device **80** signals the fueling system **40** which stops the extension mechanism **45** and maintains the nozzle **43** within the inlet **102**.

[0092] The fuel is then pumped through the hose **42** and into the vehicle **100**. Once complete, the hose **42** is retracted from the fuel inlet **102** and positioned at a retracted position in proximity to the body **41**. Further, the fuel door **104** is closed, such as by sending a signal to the actuator **70** to move the door **104** to the closed position. Further, the user is notified that the fueling process is complete and that they are able to drive the vehicle **100** away from the fueling system **10**.

[0093] In some embodiments, one or both targets **33**, **81** are equipped to detect a signal transmitted from the respective sensors **31**, **48**. The targets **33**, **81** are equipped to thereafter transmit a signal to the system **10** indicating that the respective sensor is aligned with the target.

[0094] FIG. **1** includes a system **10** positioned on a first side of the vehicle lane **110**. The station **10** may further be configured with additional lanes **110** that accommodate vehicles **100** with fuel inlets **102** at different locations. For example, a separate lane **110** may be configured to accommodate fueling vehicles **100** with fuel inlets on the passenger side. Further, an additional lane **110** may be configured to accommodate vehicles **100** with fuel inlets **102** at the rear of the vehicle **100**.

[0095] Spatially relative terms such as "under", "below", "lower", "over", "upper", and the like, are used for ease of description to explain the positioning of one element relative to a second element. These terms are intended to encompass different orientations of the device in addition to different orientations than those depicted in the figures. Further, terms such as "first", "second", and the like, are also used to describe various elements, regions, sections, etc and are also not intended to be limiting. Like terms refer to like elements throughout the description.

[0096] As used herein, the terms "having", "containing", "including", "comprising" and the like are open ended terms that indicate the presence of stated elements or features, but do not preclude additional elements or features. The articles "a", "an" and "the" are intended to include the plural as well as the singular, unless the context clearly indicates otherwise.

[0097] The present invention may be carried out in other specific ways than those herein set forth without departing from the scope and essential characteristics of the invention.

The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

What is claimed is:

1. An automated system to fuel a vehicle such that a user remains within the vehicle during fueling, the system comprising:

a drive system including a support member configured to be positioned under the vehicle and sized to receive at least one tire of the vehicle, the drive system configured to move the support member and the vehicle along a lane;

an alignment system configured to be positioned at a stationary point along the lane and configured to align the vehicle at a predetermined position along the lane as the vehicle is being moved by the drive system, the alignment system including a first target mounted to the vehicle at a first distance from a fuel inlet of the vehicle and a first sensor to detect the first target when the vehicle is at the predetermined position; and

a fueling system configured to be positioned along the lane and including a hose, a second sensor mounted to the hose, and a second target mounted to the vehicle at a second predetermined distance from the fuel inlet, the second target being spaced apart from the first target, the sensor configured to detect the second target to vertically align the hose with the fuel inlet, the fueling system further configured to extend the hose outward towards the vehicle to insert the hose into the fuel inlet when the second target is detected and the hose is aligned with the fuel inlet;

the alignment system configured to horizontally align the hose with the fuel inlet.

2. The automated system of claim **1**, wherein the fueling system comprises a pump housing that is stationary relative to the drive system with the hose being movable relative to the pump housing.

3. The automated system of claim **1**, wherein the first and second targets are different.

4. The automated system of claim **1**, wherein the drive system includes an elongated chain that is powered by a motor with the support member being connected to the chain.

5. The automated system of claim **1**, wherein the support member is a flat plate and the drive system further includes an actuator operatively connected to the plate to move the plate along the lane.

6. The automated system of claim **1**, wherein the fueling system is configured to detect the second target after the vehicle has been horizontally aligned along the lane by the alignment system.

7. The automated system of claim **1**, further comprising an actuator system to open a fuel door that extends across the fuel inlet.

8. An automated system to fuel a vehicle such that a user remains within the vehicle during fueling, the system comprising:

a first target configured to be positioned on the vehicle at a first location;

a second target configured to be positioned on the vehicle at a second location, the second target being separate from the first target;

a fueling system configured to deliver the fuel to the vehicle, the fueling system comprising a body and a hose with the hose configured to move relative to the body between extended and retracted positions;

a first sensor configured to horizontally align the vehicle with the fueling system as the vehicle moves through the system, the first sensor configured to detect the first target when a fuel inlet of the vehicle is horizontally aligned with the fueling system;

a second sensor configured to vertically align the hose with the fuel inlet of the vehicle, the second sensor configured to detect the second target when the hose is vertically aligned with the fuel inlet;

the fueling system configured to move the hose from the retracted position to the extended position when the first and second targets are detected by the first and second alignment systems.

9. The automated system of claim **8**, wherein the second sensor is positioned on the hose of the fueling system.

10. The automated system of claim **8**, further comprising a payment system that includes a module configured to be positioned on the vehicle and a sensor to detect the module.

11. The automated system of claim **8**, wherein the first and second targets include different sizes.

12. The automated system of claim **8**, further comprising a drive system configured to move the vehicle from a first point to the fueling system while the vehicle is off.

13. The automated system of claim **12**, wherein the drive system includes a chain drive with a dolly configured to receive a tire of the vehicle.

14. The automated system of claim **12**, wherein the drive system includes a plate sized to receive at least a portion of the vehicle and an actuator configured to move the plate from the first point to the fueling system.

15. The automated system of claim **8**, further comprising an actuator system to open a fuel door that extends across the fuel inlet, the actuator system configured to open the fuel door after the first sensor detects the first target.

16. An automated system to fuel a vehicle such that a user remains within the vehicle during fueling, the system comprising:

a controller configured to:

determine that the vehicle is moving along a lane;

receive a first signal from a first sensor that detects a first target on the vehicle indicating that a fuel inlet of the vehicle is horizontally aligned with a fuel hose;

stop the vehicle when the fuel inlet is horizontally aligned with the fuel hose;

vertically move the fuel hose relative to the fuel inlet;

receive a second signal from a second sensor when the second sensor detects a second target indicating that the fuel hose is vertically aligned with the fuel inlet of the vehicle;

extend the fuel hose outward towards the vehicle;

receive a third signal from a third sensor when the fuel hose is inserted into the fuel inlet of the vehicle; and

deliver fuel through the fuel hose to the vehicle after receiving the third signal.

17. The automated system of claim **16**, wherein the controller is further configured to start vertically moving the fuel hose after receiving the first signal from the first sensor.

18. The automated system of claim **16**, wherein the second sensor is connected to the fuel hose.

19. The automated system of claim **16**, wherein the first sensor is configured to detect the first target that is positioned on a leading side of the fuel inlet and the second sensor is

configured to detect the second target that is positioned on an opposing trailing side of the fuel inlet.

20. The automated system of claim **16**, wherein the controller is further configured to receive payment prior to delivering the fuel to the vehicle.

* * * * *